INF2270, exercise on combinational logic: solution

P. Häfliger

January 28, 2010

A

$$[a \oplus b] \oplus [(b \wedge c) \oplus (c \vee a))] \tag{1}$$

Truth table:

a	b	c	F
0	0	0	0
0	0	1	1
0	1	0	1
0	1	1	1
1	0	0	0
1	0	1	0
1	1	0	1
1	1	1	0

Karnaugh map:

$_{cd}\backslash^{a}$	0	1
00	0	0
01	1	0
11	1	0
10	1	1

Resulting Boolean function:

$$(\bar{a} \wedge c) \vee (b \wedge \bar{c}) \tag{2}$$

B

Boolean function:

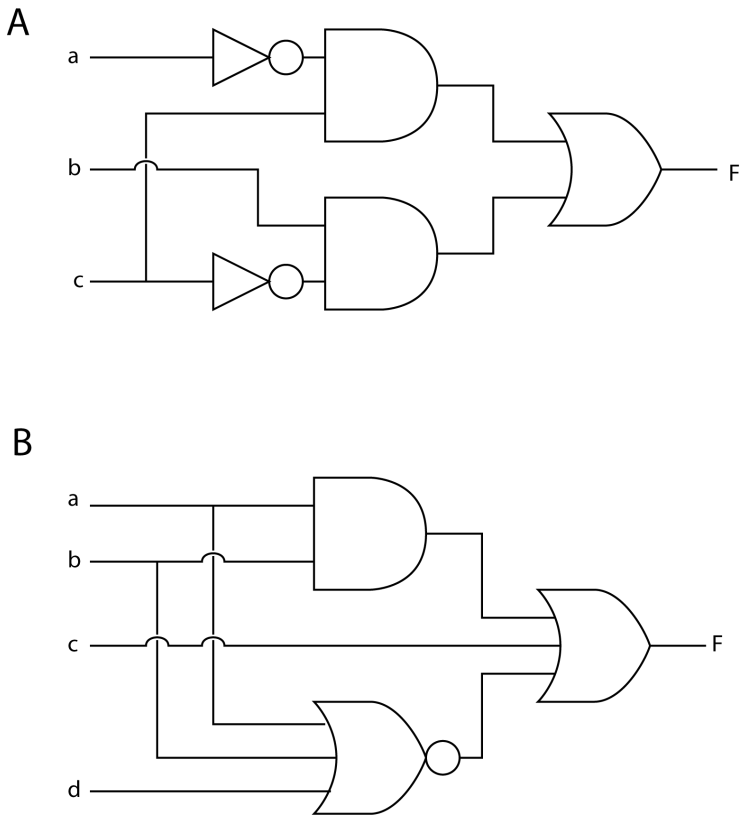

Figure 1: The resulting simplified circuits

$$[((a \wedge b) \vee c) \oplus (c \wedge (b \vee d))] \vee [(c \wedge (b \vee d)) \oplus (\overline{(b \vee d) \vee a})] \tag{3}$$

Truth table:

a	b	c	d	F
0	0	0	0	1
0	0	0	1	0
0	0	1	0	1
0	0	1	1	1
0	1	0	0	0
0	1	0	1	0
0	1	1	0	1
0	1	1	1	1
1	0	0	0	0
1	0	0	1	0
1	0	1	0	1
1	0	1	1	1
1	1	0	0	1
1	1	0	1	1
1	1	1	0	1
1	1	1	1	1

Karnaugh map:

$_{cd}\backslash^{ab}$	00	01	11	10
00	1	0	1	0
01	0	0	1	0
11	1	1	1	1
10	1	1	1	1

Resulting Boolean function:

$$c \vee (a \wedge b) \vee (\bar{a} \wedge \bar{b} \wedge \bar{d}) \tag{4}$$

Its tempting to use deMorgan on that last term also, to get rid of the inverters in the final circuit:

$$c \vee (a \wedge b) \vee \overline{(a \vee b \vee d)} \tag{5}$$